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(54) **RACK SERVER SYSTEM AND CONTROL METHOD THEREOF**

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G06F 11/00	(2006.01)
G06F 11/20	(2006.01)

(52) **U.S. Cl.**

CPC ***G06F 1/30*** (2013.01); ***G06F 11/24*** (2013.01); *G06F 11/006* (2013.01); *G06F 11/2015* (2013.01)

(58) **Field of Classification Search**

CPC H02J 9/062; H02J 9/061; H02J 7/0013; G01R 31/3658; G06F 1/30

USPC 702/13, 108, 63; 307/11, 66, 43, 65

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,565,759	A	10/1996	Dunstan	
5,583,440	A *	12/1996	Bisher	324/426
5,710,503	A *	1/1998	Sideris et al.	324/431
5,886,503	A *	3/1999	McAndrews et al.	320/121
6,356,057	B1 *	3/2002	Shilo et al.	320/127
6,983,212	B2 *	1/2006	Burns	702/63
7,015,699	B1 *	3/2006	Suntio	324/429
7,340,325	B2 *	3/2008	Sousa et al.	700/295

(Continued)

FOREIGN PATENT DOCUMENTS

CN	1614439	5/2005
CN	102118058	7/2011

(Continued)

OTHER PUBLICATIONS

LeFranc, E., "Battery-Switching Circuit for Dual-Battery Systems," International Business Machines, Jan. 28, 2005.*

(Continued)

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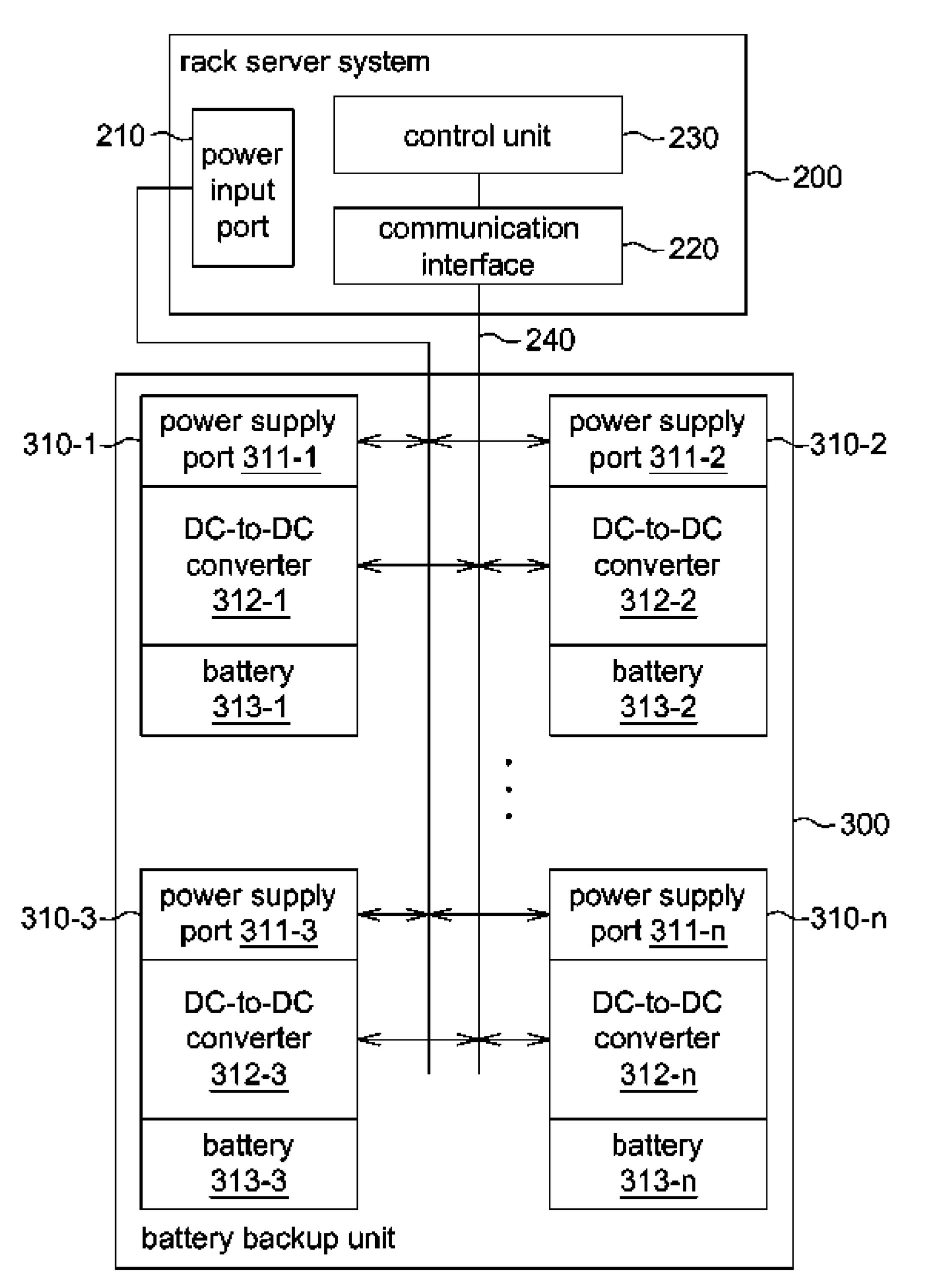
(57) **ABSTRACT**

A rack server system and a control method thereof are provided. The rack server system establishes a communication link for communicating with a battery backup unit. The battery backup unit is connected to a power input port of the rack server system, and includes a number of battery modules connected with each other in parallel. The rack server system controls the battery backup unit to perform validity test on a first battery module during a first period and to perform validity test on a second battery module during a second period, wherein the first period and the second period are not overlapped with each other.

22 Claims, 5 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

7,612,472	B2 *	11/2009	Mutabdzija	H01M 10/48 307/150
8,375,249	B1 *	2/2013	LoRusso	714/22
2002/0033692	A1	3/2002	Sakai et al.	
2005/0225914	A1 *	10/2005	King	361/62
2006/0028079	A1 *	2/2006	Matsunaga	310/120
2007/0136453	A1 *	6/2007	Ewing	G06F 1/26 709/223
2008/0030078	A1	2/2008	Whitted et al.	
2009/0125156	A1 *	5/2009	Killian et al.	700/291
2010/0056228	A1 *	3/2010	Brown	G06F 21/81 455/572
2011/0304211	A1 *	12/2011	Peterson et al.	307/48
2012/0116590	A1 *	5/2012	Florez-Larrahondo	G06F 1/206 700/275
2012/0134090	A1 *	5/2012	Peng	361/679.31
2013/0099756	A1 *	4/2013	Mohr et al.	320/134

FOREIGN PATENT DOCUMENTS

JP	06-124145	A	5/1994
JP	09-172744	A	6/1997
JP	2003-309935	A	10/2003
TW	200803113		1/2008
TW	200803113	A	1/2008

OTHER PUBLICATIONS

<http://nomano.shiwaza.com/tnoma/blog/archives/006634.html> UPS, [online], Pub. Date, Aug. 15, 2013.

Office Action mailed Aug. 27, 2014; in corresponding Chinese patent application No. 201110247955.3.

English abstract for TW200803113; published on Jan. 1, 2008 and retrieved on Oct. 16, 2014.

English abstract for CN102118058; published on Jul. 6, 2011 and retrieved on Oct. 16, 2014.

English abstract for CN1614439; published on May 11, 2005 and retrieved on Oct. 16, 2014.

* cited by examiner

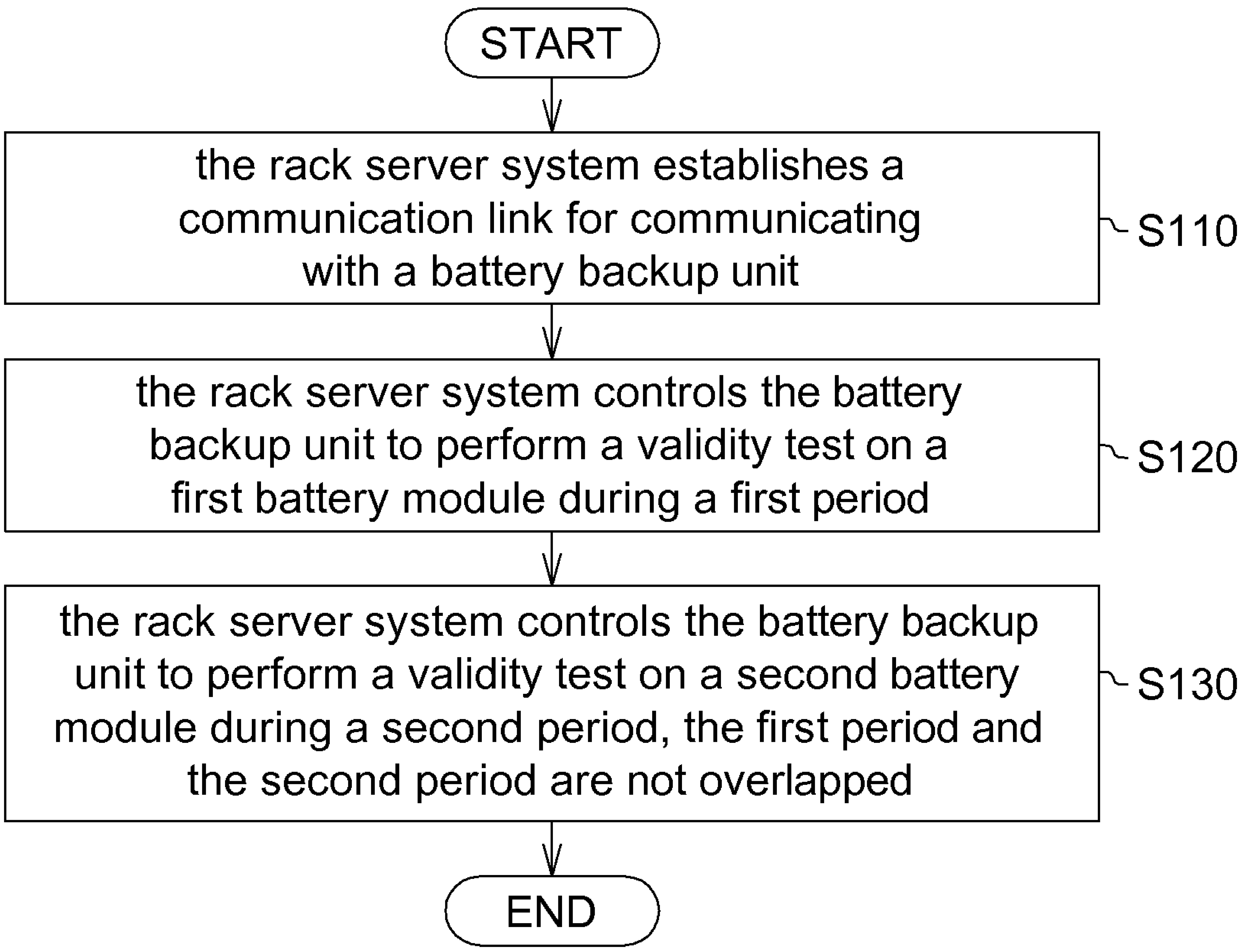

START
the rack server system establishes a communication link for communicating with a battery backup unit
S110
the rack server system controls the battery backup unit to perform a validity test on a first battery module during a first period
S120
the rack server system controls the battery backup unit to perform a validity test on a second battery module during a second period, the first period and the second period are not overlapped
S130
END

FIG. 1

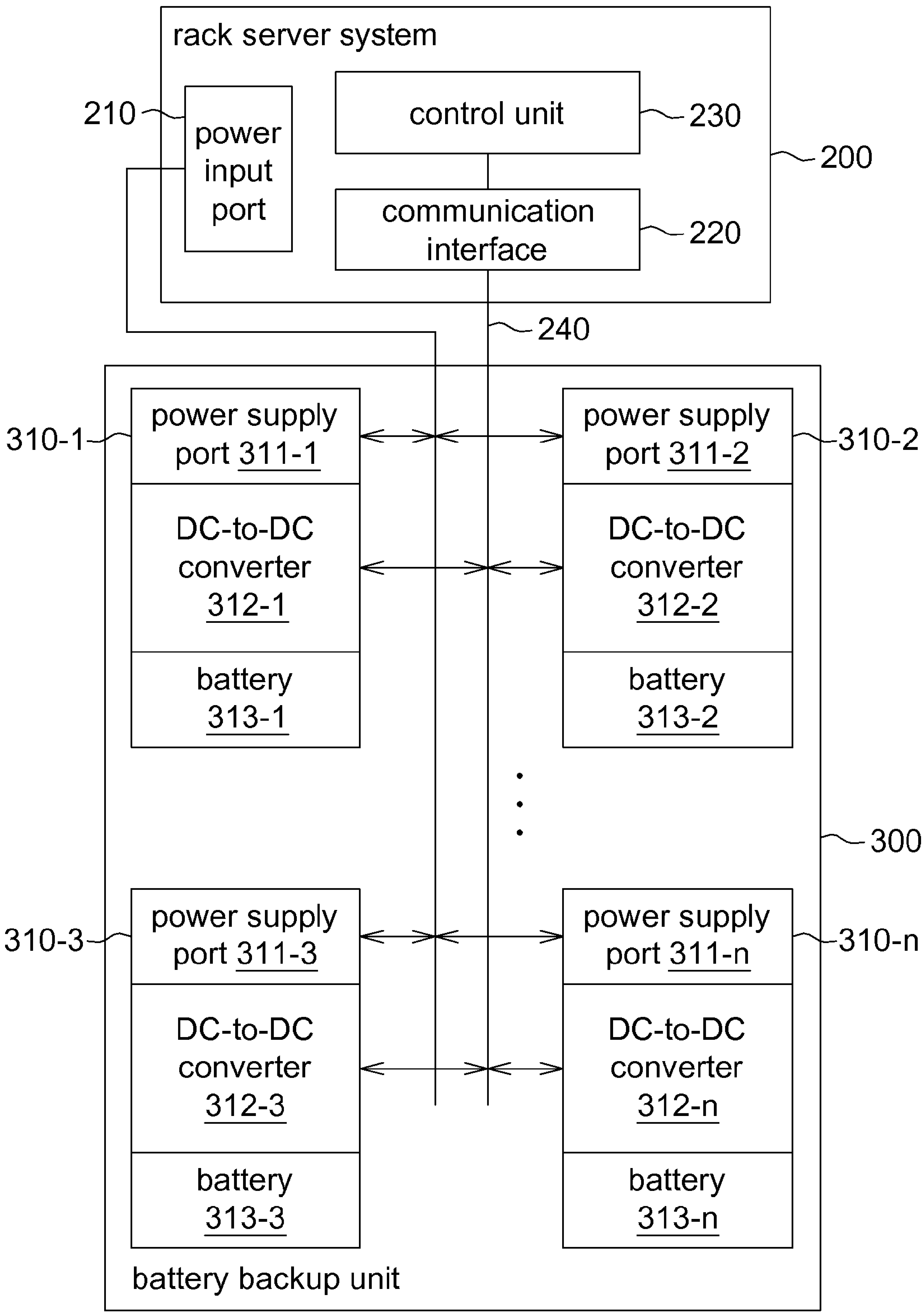

rack server system
210
power input port
control unit
230
200
communication interface
220
240
power supply port 311-1
310-1
power supply port 311-2
310-2
DC-to-DC converter 312-1
DC-to-DC converter 312-2
battery 313-1
battery 313-2
300
power supply port 311-3
310-3
power supply port 311-n
310-n
DC-to-DC converter 312-3
DC-to-DC converter 312-n
battery 313-3
battery 313-n
battery backup unit

FIG. 2

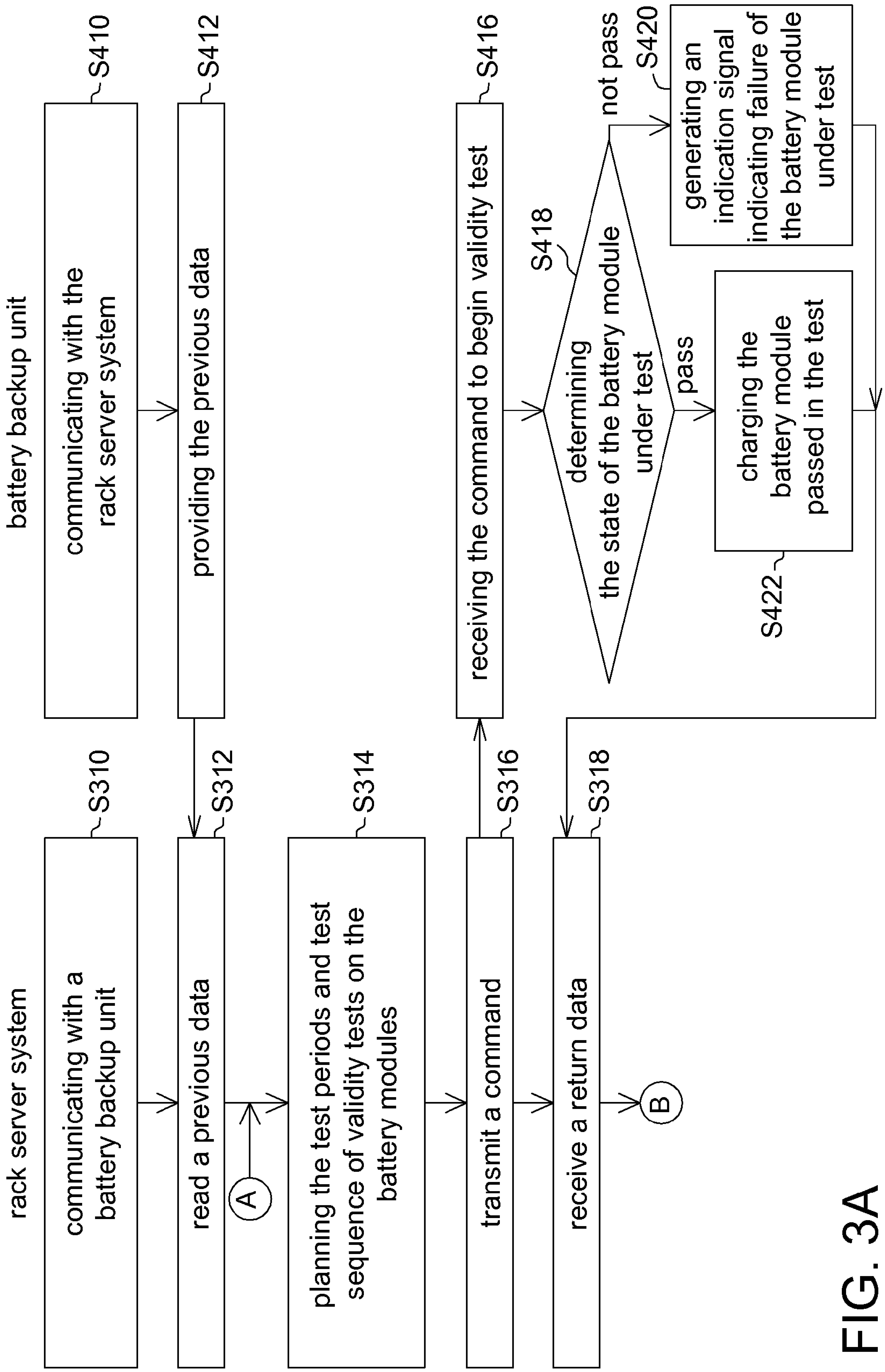

rack server system
communicating with a battery backup unit
S310
read a previous data
S312
A
planning the test periods and test sequence of validity tests on the battery modules
S314
transmit a command
S316
receive a return data
S318
B
battery backup unit
communicating with the rack server system
S410
providing the previous data
S412
receiving the command to begin validity test
S416
determining the state of the battery module under test
S418
pass
not pass
charging the battery module passed in the test
S422
generating an indication signal indicating failure of the battery module under test
S420

FIG. 3A

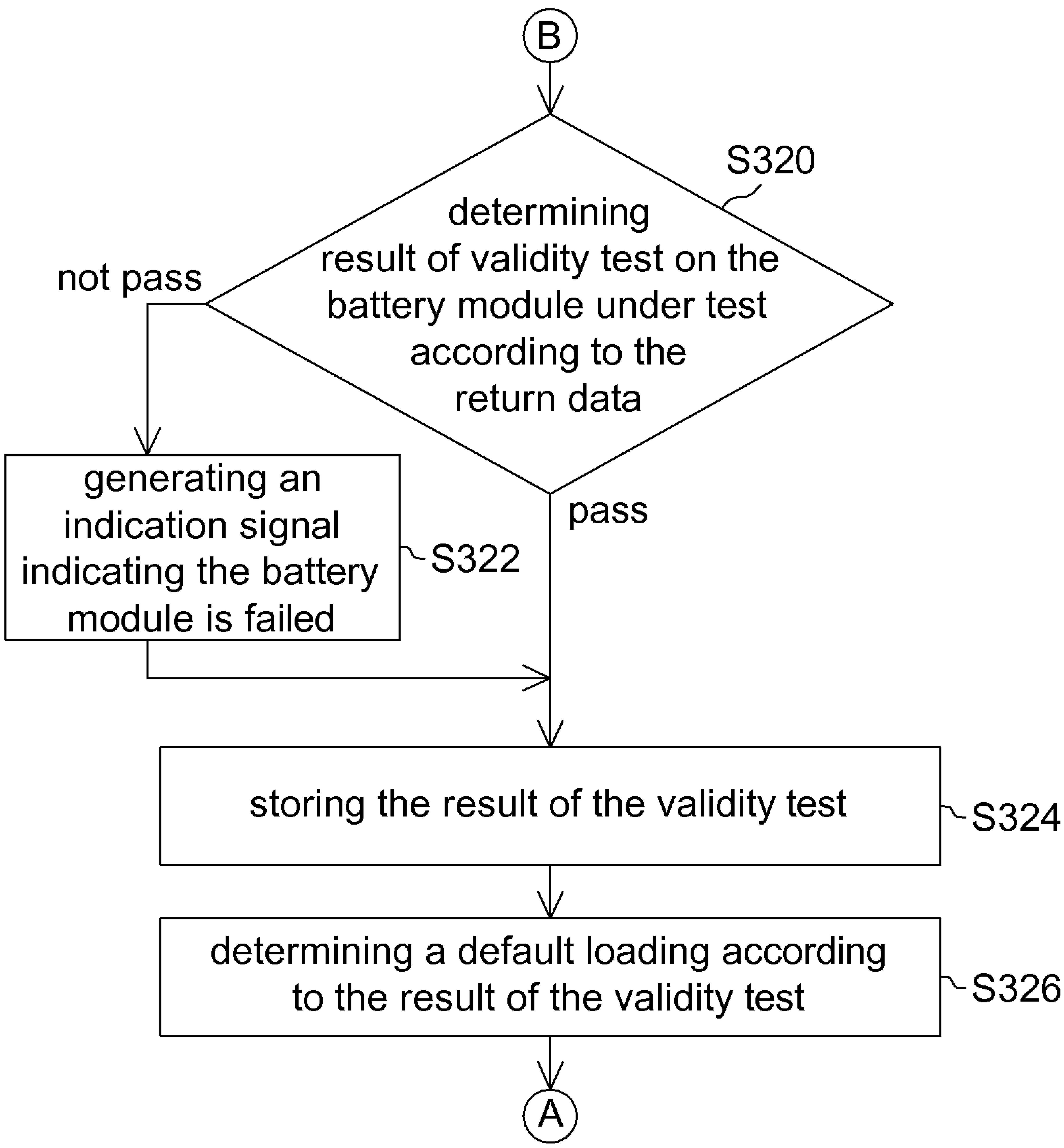

B
determining result of validity test on the battery module under test according to the return data
S320
not pass
pass
generating an indication signal indicating the battery module is failed
S322
storing the result of the validity test
S324
determining a default loading according to the result of the validity test
S326
A

FIG. 3B

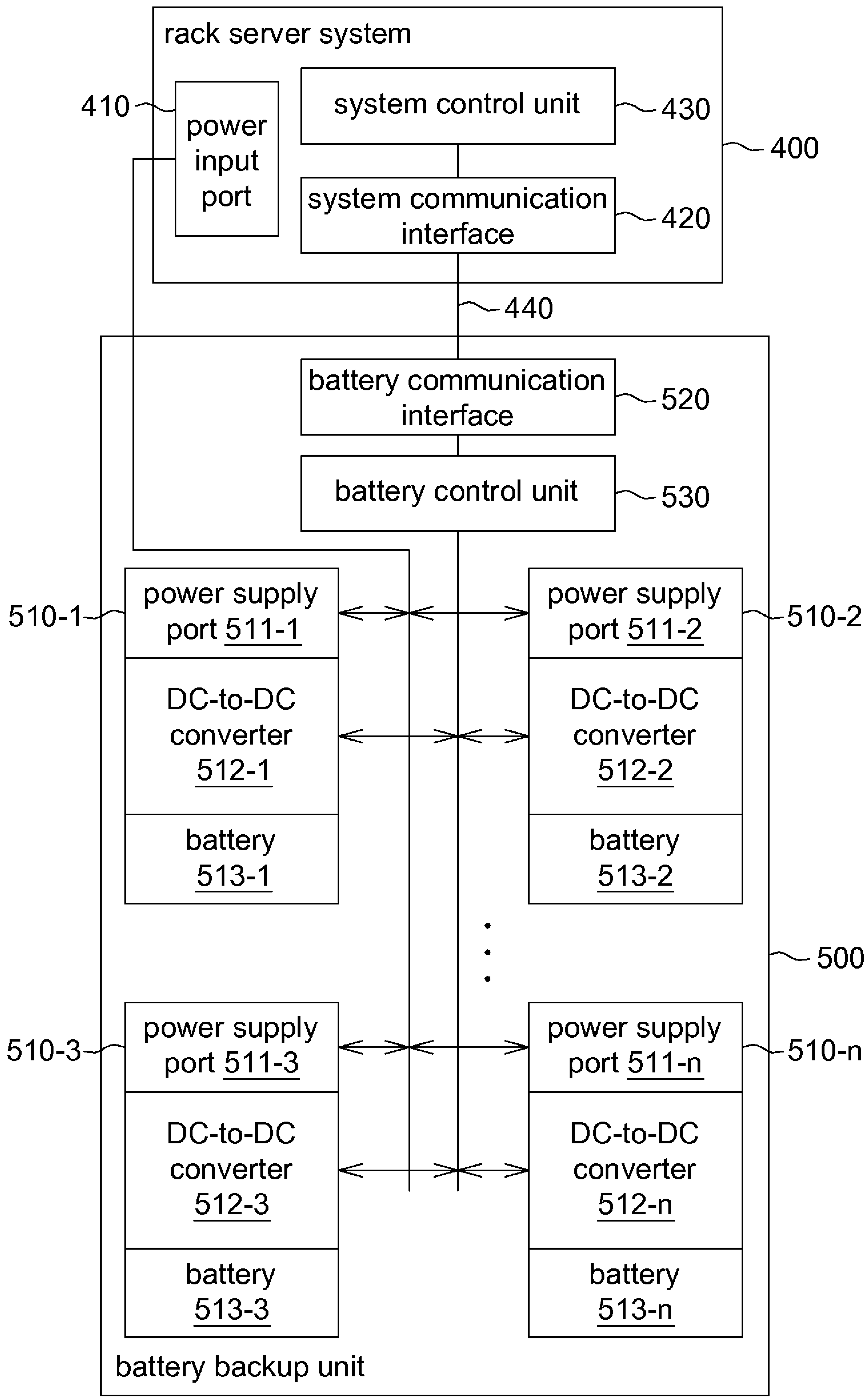

rack server system
410
power input port
system control unit
430
400
system communication interface
420
440
battery communication interface
520
battery control unit
530
510-1
power supply port 511-1
DC-to-DC converter 512-1
battery 513-1
510-2
power supply port 511-2
DC-to-DC converter 512-2
battery 513-2
500
510-3
power supply port 511-3
DC-to-DC converter 512-3
battery 513-3
510-n
power supply port 511-n
DC-to-DC converter 512-n
battery 513-n
battery backup unit

FIG. 4

RACK SERVER SYSTEM AND CONTROL METHOD THEREOF

This application claims the benefit of Taiwan application Serial No. 100126882, filed Jul. 28, 2011, the subject matter of which is incorporated herein by reference.

TECHNICAL FIELD

The disclosure relates in general to a rack server system and a control method thereof, and more particularly to a rack server system which controls a battery backup unit via a communication interface to perform validity test and a control method thereof.

BACKGROUND

A battery backup unit may replace the uninterruptible power supply (UPS). Under the circumstances when abnormality (such as power off, power insufficient, power interference or surge) occurs to a main power supplied to a rack server system, the battery backup unit supplies power to the rack server system to maintain normal operation; and a power supply apparatus such as a power generator is activated to provide backup power. In general, the battery backup unit is used for maintaining necessary operations for critical commercial or precision apparatuses, such as rack server systems, switches, to prevent data loss lest the business might suffer from tremendous loss or other unexpected consequences.

Validity of the battery backup unit has much to do with system stability. If the battery backup unit fails due to aging or other factors, the battery backup unit may not maintain the normal operation of the rack server system when abnormality occurs to the main power supplied to the rack server system, and data may be lost. To assure the validity of the battery backup unit, validity test such as discharge test is performed on the battery backup unit periodically to obtain whether the battery has sufficient power.

However, if abnormity, such as power off, occurs to the main power supplied to the rack server system when the battery backup unit is in discharge test, power stored in the battery backup unit may be nearly used up and the battery backup unit may be unable to maintain the normal operation of the rack server system. Meanwhile, the rack server system may have stability problem which may lead to data loss. Therefore, how to reduce the risk of data loss of the rack server system has become a prominent task for the industries.

SUMMARY OF THE DISCLOSURE

The disclosure is directed to a rack server system and a control method thereof which reduce the risk of data loss of the rack server system when a battery backup unit is in validity test.

According to an example of the present disclosure, a control method applicable to a rack server system is provided. The rack server system establishes a communication link for communicating with a battery backup unit. The battery backup unit is connected to a power input port of the rack server system, and includes a number of battery modules connected with each other in parallel. The rack server system controls the battery backup unit to perform a validity test on a first battery module during a first period and to perform a validity test on a second battery module during a second period, wherein the first period and the second period are not overlapped with each other.

According to another example of the present disclosure, a rack server system is provided. The rack server system includes a power input port, a communication interface and a control unit. The power input port is connected to a battery backup unit. The battery backup unit includes a number of battery modules connected with each other in parallel. The communication interface establishes a communication link for communicating with the battery backup unit. The control unit is connected to the communication interface. The control unit controls the battery backup unit to perform a validity test on a first battery module during a first period and to perform a validity test on the validity of a second battery module during a second period, wherein the first period and the second period are not overlapped with each other.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the disclosed embodiments, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a flowchart of a control method according to one embodiment of the disclosure;

FIG. **2** shows a block diagram of an example of a rack server system and a battery backup unit according to one embodiment of the disclosure;

FIG. **3**A and FIG. **3**B show timing diagrams of an example of communication between the rack server system and the battery backup unit of FIG. **2**; and

FIG. **4** shows a block diagram of another example of a rack server system and a battery backup unit according to one embodiment of the disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

A rack server system and a control method thereof are disclosed in a number of embodiments below. In some embodiments, a battery backup unit includes a number of battery modules connected in parallel. The battery modules are controlled by a rack server system via a communication interface; and validity test such as discharge test is performed on the battery modules in time-sharing. In other words, when a part of the battery modules are under validity test, other part of the battery modules are not under validity test and are ready to provide power to the rack server system. Thus, the risk of data loss of the rack server system is reduced.

Referring to FIG. **1**, a flowchart of a control method according to one embodiment of the disclosure is shown. The control method is for use in the rack server system. At step **S110**, the rack server system establishes a communication link for communicating with a battery backup unit. The battery backup unit is connected to a power input port of the rack server system. The battery backup unit includes a number of battery modules connected in parallel. At step **S120**, the rack server system controls the battery backup unit to test validity of a first battery module of the battery backup unit during a first period. At step **S130**, the rack server system controls the battery backup unit to test validity of a second battery module of the battery backup unit during a second period. The first period and the second period are not overlapped with each other. The two non-overlapping periods refer that the two battery modules of the battery backup unit are under validity test in time-sharing to reduce the risk of data loss of the rack server system.

Referring to FIG. **2**, a block diagram of an example of the rack server system and the battery backup unit according to one embodiment of the disclosure is shown. The rack server system **200** may be realized by such as but not limited to a cloud computing rack server system. The rack server system **200** such as includes a number of servers (not illustrated) inside a rack. The rack server system **200** at least includes a power input port **210**, a communication interface **220**, and a control unit **230**. In FIG. **2**, the rack server system **200** of the present example is illustrated as a basic model for convenience of elaborating the embodiments of the disclosure, and in fact, rack server system should include other circuits not illustrated here.

The power input port **210** is connected to a battery backup unit **300**. For example, the power input port **210** may be realized by a DC power input port for receiving DC power. The power input port **210** may include two or more input ends for receiving DC power having different polarities or different levels such as receiving power from an AC/DC power supply or receiving power from the battery backup unit **300**. When abnormality occurs to a main power supplied the rack server system **200**, the power input port **210** feeds the power from the battery backup unit **300** to the system **200**, such that the system **200** is powered for maintaining normal operations.

The communication interface **220** establishes a communication link for communicating with the battery backup unit **300**. In some embodiments, the communication interface **220** is a wireless communication interface such as Bluetooth, wireless fidelity (Wi-Fi), or other wireless communication standards or wireless communication protocols. In some other embodiments, the communication interface **220** is such as a wire communication interface, which may be connected to the battery backup unit **300** via a communication bus **240** of the rack server system **200**. The communication bus **240** is such as an RS232 bus, an I^2C bus, a controller area network (CAN) bus, or other bus.

The control unit **230** is connected to the communication interface **220**. Via the communication interface **220**, the control unit **230** controls the battery backup unit **300** to perform validity test on the battery backup unit **300**. In the present embodiment of the disclosure, the battery backup unit **300** includes a number of battery modules **310-1~310-*n*** connected in parallel as indicated in FIG. **2**. The control unit **230** plans or arranges execution times and execution sequence of validity tests on the battery modules **310-1~310-*n*** for reducing risk of data loss of the rack server system.

In some embodiments, the control unit **230** may control the battery backup unit **300** to test validity of the battery modules **310** one by one, sequentially or non-concurrently. For example, the control unit **230** may control the battery backup unit **300** so as to test validity of the first battery module **310-1** during a first period and to test validity of a second battery module **310-2** during a second period, wherein the first period and the second period are not overlapped with each other. The validity test periods on other battery modules **310-3~310-*n*** may be arranged similarly. Thus, during any test period, the rack server system **200** may be powered by battery modules not under validity test, and the risk of data loss of the rack server system may thus be reduced.

In some other embodiments, the control unit **230** may control the battery backup unit **300** to test validity of a part of the battery modules (such as two or more battery modules) during a first period and test validity of another part of the battery modules (such as another two or more battery modules) during a second period. Thus, during any test period, the rack server system **200** may be powered by battery modules not under validity test, and risk of data loss of the rack server system can thus be reduced.

For the battery backup unit **300**, each of the battery modules **310-1-310-*n*** includes similar elements. Let the battery module **310-1** be taken for example. The battery module **310-1** includes a power supply port **311-1**, a DC-to-DC converter **312-1**, and a battery **313-1**. The power supply port **311-1** is coupled to the power input port **210** of the rack server system **200**. The DC-to-DC converter **312-1** is connected between the battery **313-1** and the power supply port **311-1** for converting a voltage of the battery **313-1** into a voltage for the rack server system **200**. The battery **313-1** is such as a secondary battery or other type. In some implementation examples, the battery **313-1** is such as a lithium battery. In some other implementation examples, the battery **313-1** is such as a reusable battery, a rechargeable battery or a replaceable battery.

The arrangement of a number of battery modules increases the power supply stability of the battery backup unit **300**. In other words, if one battery module fails, other battery modules of the battery backup unit **300** still provides power to the rack server system **200**. Thus, stability of the rack server system **200** is kept so as to reduce risk of data loss of the rack server system.

Moreover, for the battery backup unit **300**, via the validity test, the control unit **230** knows whether the battery backup unit **300** fails due to aging or other factors, so as to assure validity of the battery backup unit **300**. In an implementation example, the validity test on the battery backup unit **300** is such as discharge test. During the discharge test, the battery backup unit **300** increases its output voltage so as to provide energy to the rack server system **200**. In other implementation example, if the battery backup unit **300** uses lithium battery, then the validity test is a learning curve test which records the relationship between usage time and voltage. However, the disclosure is not limited to such exemplification, and the validity test on the battery backup unit **300** is based on the types of the battery modules or on user request.

Referring to FIG. **3**A and FIG. **3**B, timing diagrams of an example of the communication between the rack server system and the battery backup unit of FIG. **2** are shown. The disclosure is further elaborated below in conjunction with FIG. **2** and FIGS. **3**A and **3**B.

At step S**310**, the rack server system **200** establishes a communication link for communicating with the battery backup unit **300**. Correspondingly, in step S**410**, the battery backup unit **300** communicates with the rack server system **200**.

In step S**312**, the rack server system **200** reads previous data to obtain result(s) of previous validity test(s) and execution time(s) on the battery backup unit **300**. Correspondingly, in step S**412**, the battery backup unit **300** provides previous test data to the rack server system **200**. Test data is stored in a memory of the battery backup unit **300**, such as a non-volatile memory. Data read by the rack server system **200** are information such as the execution time and the result of a previous validity test on the battery modules **310-1~310-*n***, or other information such as lifespan, manufacturer, manufacture date, and electrical characteristics.

In step S**314**, the rack server system **200** plans or arranges the execution times and test sequence of validity tests on the battery modules **310-1~310-*n***. The rack server system **200** such as plans or arranges the execution times and sequence of validity tests on the battery modules **310-1~310-*n*** according to the read data. For example, considering system stability, the execution times of validity tests on the battery modules **310-1~310-*n*** are neither concurrent nor overlapped with each other. The execution sequences of validity test on the battery modules **310-1~310-*n*** are such as determined according to previous execution times. For example, the earlier the previous test time on a battery module, the higher sequence priority of the validity test on the battery module. The execution time of validity tests on the battery modules **310-1~310-*n*** are determined according to previous execution results of the battery modules **310-1~310-*n***. For example, the battery module(s) which was/were failed in the previous validity test may be not tested so as to reduce the total test time.

In step S**316**, the rack server system **200** sends a command to notify the battery backup unit **300** for a validity test. Correspondingly, in step S**416**, the battery backup unit **300** receives the command to begin validity test. For example, the battery backup unit **300** increases the output voltage to release energy.

In step S**318**, the rack server system **200** receives a return data indicating the test result. Correspondingly, in step S**418**, the battery backup unit **300** determines the state of the battery module(s) under test. If the test result indicates "pass", then the method proceeds to step S**422**, the battery backup unit **300** charges the battery module(s) passed in the test, and after charging finishes, the battery backup unit **300** transmits the return data and the method proceeds to step S**318**. If the test result indicates "fail", then the method proceeds to step S**420**, the battery backup unit **300** controls an indicator such as a light emitting diode (LED) to generate an indication signal such as a light signal indicating failure of the battery module(s) under test. Some embodiments may further include other steps for generating the return data indicating the test result or steps for storing the test result to a memory (not shown) of the battery backup unit **300**.

In step S**320**, the rack server system **200** determines the result of validity test on the battery module(s) according to the return data. If the test result indicates "fail", then the method proceeds to step S**322**. If the test result indicates "pass", then the method proceeds to step S**324**.

In step S**322**, the rack server system **200** generates the indication signal, such as a light signal, an audio signal, or a signal for displaying a message on a screen, to notify or remind the user to replace the battery module. Then, the method proceeds to step S**324**.

In step S**324**, the rack server system **200** stores the results of validity test. Via the communication interface **220**, the test result is transmitted to the control unit **230** and may be further stored in a memory (not shown) of the control unit **230** or other memory not shown.

In step S**326**, the rack server system **200** determines a default loading according to the results of validity tests on the battery modules **310-1~310-*n***. The default loading determines efficiency of the rack server system **200** when abnormality occurs to the main power supplied to the rack server system **200**. The default loading such as determines the loading of the rack server system when abnormality occurs to the main power.

In some embodiments, the default loading determines the number of normal operating servers of the rack server system when abnormality occurs to the main power. For example, under full-loading, the rack server system **200** may activate all servers so as to operate at high efficiency and at high power consumption. Under half-loading, the rack server system **200** activates half of the servers and shut down another half of the servers safely, and both efficiency and power consumption are reduced.

In some embodiments, the default loading determines operation frequency of a processor of each server of the rack server system when abnormality occurs to the main power. For example, under full-loading, the processor of each server of the rack server system **200** operates at highest operation frequency, high efficiency but high power consumption. Under half-loading, the operation frequency of the processor of each server of the rack server system **200** is half, and efficiency and power consumption are reduced.

The above default loading for determining the number of the active servers and/or for determining the operation frequency of the processor of the server is for exemplification purpose not for limiting the disclosure. The default loading may also be other parameters relating to the efficiency, loading, or power consumption of the rack server system when abnormality occurs to the main power.

In some embodiments, when a battery module is failed in the validity test, the rack server system **200** may reduce the default loading. The default loading is such as reduced according to the number of the failed battery modules. Suppose 10 battery modules are used, and the initial default loading is full-loading. When one battery module fails, the default loading may be reduced by 1 tenth as 9-tenth loading. When a half of the battery modules fails, the default loading may be reduced by 5 tenths as half-loading. Thus, when abnormality occurs to the main power of the rack server system **200**, the rack server system **200** avoids operating at high efficiency and/or high power consumption. Thus, the stability of the rack server system is kept so as to reduce the risk of data loss of the rack server system.

Referring to FIG. **4**, a block diagram of another example of a rack server system and a battery backup unit according to one embodiment of the disclosure is shown.

In the present example, the rack server system **400** includes a power input port **410**, a system communication interface **420**, and a system control unit **430**. The operations of the rack server system **400** are similar to that of the rack server system **200** of FIG. **2**, and the similarities are not repeated here.

The battery backup unit **500** includes a number of battery modules **510-1~510-*n*** connected in parallel, and further includes a battery communication interface **520** and a battery control unit **530**. The battery control unit **530** and the rack server system **400** communicate with each other and may implement the above control method.

The battery control unit **530** may execute a part of operations of the system control unit **430**. For example, the battery control unit **530** receives a notification from the system control unit **430** and controls the battery modules **510-1~510-*n*** to perform validity test in time-sharing. In another example as indicated in step S**314**, the battery control unit **530** may plan and arrange the execution time and sequence of validity test.

No matter the rack server system controls the battery backup unit to perform validity test or the rack server system notifies the control unit of the battery backup unit to perform validity test, those are possible embodiments of the disclosure as long as battery modules of the battery backup unit are tested in time-sharing.

According to the rack server system and the control method thereof of the present embodiment of the disclosure, the battery backup unit includes a number of battery modules connected with each other in parallel and the battery modules are controlled by the rack server system via the communication interface to be tested such as a discharge test in a time-sharing manner, so as to reduce the risk of data loss of the rack server system.

In some embodiments, with the configuration of the battery backup unit (which is modularized) and the communication interface, the rack server system notifies the battery modules to be under test (i.e. system control). The advantage of system control is that all loading conditions are taken into consideration to avoid interrupt of power supply during test or due to failure of the battery module. In cooperation with the battery backup unit which is modularized, the system controls the battery modules under validity test at different periods (i.e. in time-sharing), so as to keep system stability.

In some other embodiments, the power consumption of the rack server system when abnormality occurs to the main power may be determined according to the results of validity tests on the battery modules, so as to avoid the rack server system operating at high efficiency and high power consumption. Thus, the risk of data loss of the rack server system may be further reduced.

It will be appreciated by those skilled in the art that changes could be made to the disclosed embodiments described above without departing from the broad inventive concept thereof. It is understood, therefore, that the disclosed embodiments are not limited to the particular examples disclosed, but is intended to cover modifications within the spirit and scope of the disclosed embodiments as defined by the claims that follow.

What is claimed is:

1. A control method applicable to a rack server system, comprising:
- establishing a communication link between the rack server system and a battery backup unit, wherein the battery backup unit is connected to a power input port of the rack server system, and comprises a plurality of battery modules connected with each other in parallel;
- controlling the battery backup unit by the rack server system to perform a validity test on a first battery module of the battery modules during a first period, wherein the validity test further comprises increasing the output voltage of the battery backup unit supplied to the rack server system while the rack server system is supplied with a main power to the rack server system;
- controlling the battery backup unit by the rack server system to perform the validity test on a second battery module of the battery modules during a second period, wherein the first period and the second period are not overlapped with each other; and
- determining a default loading by the rack server system based at least upon the results of the validity tests on the first battery module and the second battery module, wherein the default loading is adjusted based at least upon a number of battery modules that failed the validity test.

2. The control method according to claim **1**, further comprising:
- receiving a return data from the battery backup unit to the rack server system; and
- determining a result of the validity test on the first battery module by the rack server system according to the return data.

3. The control method according to claim **1**, wherein the validity test on the first battery module or the second battery module includes a discharge test.

4. The control method according to claim **1**, further comprising:
- determining a default loading by the rack server system according to results of validity test on the battery modules, wherein the default loading determines efficiency of the rack server system when abnormality occurs to a main power supplied to the rack server system.

5. The control method according to claim **4**, wherein when the validity test on one of the battery modules shows failed, the rack server system reduces the default loading.

6. The control method according to claim **5**, wherein the rack server system reduces the default loading according to a number of failed battery modules.

7. The control method according to claim **4**, wherein the default loading determines a loading of the rack server system when abnormality occurs to the main power.

8. The control method of claim **1**, wherein the validity test further comprises:
- measuring the usage time and voltage output of the first battery module;
- recording the usage time and voltage output of the first battery module;
- comparing the usage time and voltage output of the first battery module to previous usage time and voltage output of the first battery module to determine performance data of the battery module; and
- communicating the performance data to the rack server system.

9. The control method according to claim **1**, wherein the validity test on the first battery module or the second battery module is performed on a time-sharing basis.

10. A rack server system, comprising:
- a power input port connected to a battery backup unit, wherein the battery backup unit comprises a plurality of battery modules connected with each other in parallel;
- a communication interface establishing a communication link for communicating with the battery backup unit;
- a control unit connected to the communication interface for controlling the battery backup unit to perform a validity test on a first battery module of the battery modules during a first period by increasing the output voltage of the battery backup unit supplied to the rack server system and controlling the battery backup unit to perform a validity test on a second battery module of the battery backup unit during a second period by increasing the output voltage of the battery backup unit supplied to the rack server system, wherein the first period and the second period are not overlapped with each other; and
- wherein the rack server system further determines a default loading based at least upon results of the validity tests on the first battery module and the second battery module; and wherein the default loading is adjusted based at least upon a number of battery modules that failed the validity test.

11. The rack server system according to claim **10**, wherein each battery module comprises:
- a power supply port connected to the power input port of the rack server system;
- a battery; and
- a DC-to-DC converter connected between the battery and the power supply port.

12. The rack server system according to claim **11**, wherein the battery is a secondary battery.

13. The rack server system according to claim **10**, further comprising:
- a communication bus connecting the communication interface to the battery backup unit.

14. The rack server system according to claim **10**, wherein the rack server system further receives a return data from the battery backup unit, and determines a result of the validity test on the first battery module according to the return data.

15. The rack server system according to claim **10**, wherein the validity test on the first battery module or the second battery module includes a discharge test.

16. The rack server system according to claim **10**, wherein the rack server system further determines a default loading according to results of validity tests on the battery modules, and the default loading determines efficiency of the rack server system when abnormality occurs to a main power supplied to the rack server system.

17. The rack server system according to claim **16**, wherein the first battery module is failed in the validity test, the rack server system reduces the default loading.

18. The rack server system according to claim **17**, wherein the rack server system includes the default loading according to a number of failed battery modules.

19. The rack server system according to claim **16**, wherein the default loading determines a loading of the rack server when abnormality occurs to the main power.

20. The rack server system according to claim **10**, wherein the battery backup unit further comprises:

another communication interface connected to the battery modules; and

another control unit connected to the another communication interface and controlled by the rack system for controlling the battery modules to perform the validity test.

21. The rack server system according to claim **16**, wherein the default loading determines operation frequency of a processor of each server of the rack system server when abnormality occurs to main power.

22. The rack server system of claim **10**, wherein the validity test further determines the usage time and voltage output of the first battery module, records the usage time and voltage output of the first battery module, compares and records the usage time and voltage output of the first battery module to determine performance data, and communicates the performance data to the rack server system.

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